NRL Report 7930

A Program to Plot an Annotated Track or a Track and Bathymetry or Magnetic Profile on a Mercator Projection

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

A program has been written for plotting an annotated track or for plotting a track and the superimposed bathymetry or magnetic profile on a Mercator projection. The program reads the data (navigation, bathymetry, or magnetics) from a magnetic tape in BCD form.

The program will annotate every point or every nth point. Navigation is annotated with fix numbers, bathymetry will uncorrected fathoms, meters, or corrected meters, and magnetics with the residual magnetic intensity. → next page

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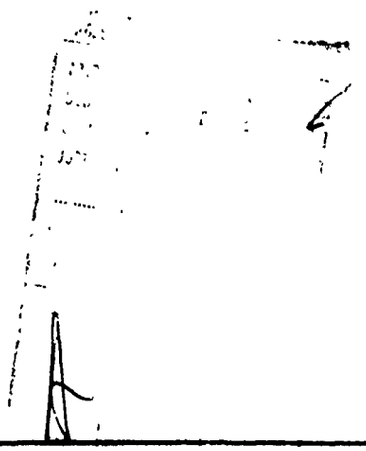
The profile series is plotted perpendicular to the track, using uncorrected fathoms or meters for bathymetry and residual magnetic intensity for magnetics.

The program was written in Fortran IV for use on a CDC 3800 computer; however, the program can be converted to run on other systems with little difficulty.



CONTENTS

A PROGRAM TO PLOT AN ANNOTATED TRACK OR A TRACK AND BATHYMETRY OR MAGNETIC PROFILE ON A MERCATOR PROJECTION

1.0 IDENTIFICATION

1.1 Title

A Program to Plot an Annotated Track or a Track and Bathymetry or Magnetic Profile on a Mercator Projection.

1.2 Identification Name

Mercator.

1.3 Classification Code

None.

1.4 RCC Identification Number

None.

1.5 Entry Points

MERCATOR.

1.6 Programming Language

Language: CDC 3600/3800 Fortran.
Routine Type: Program.
Operating System: Drum Scope 2.1.

1.7 Computer and Configuration

CDC 3800.

1.8 Contributor or Programmer

Marilyn L. Blodgett, Code 8176MB, Propagation Branch, written for the Environmental Sciences Section, Acoustics Division.

1.9 Contributing Organization

NRL — Naval Research Laboratory, Washington, D.C. 20375.

1.10 Program Availability

If supplied with a magnetic tape, the Environmental Sciences Section, Acoustics Division, will make a copy of this program.

Manuscript submitted September 3, 1975.

1.11 Verification

This program has been used and tested by the Environmental Sciences Section, Acoustics Division, for several months.

1.12 Date

May 1976.

2.0 PURPOSE

2.1 Description of the Routine

This program reads the data collected by an oceanographic or geophysical experiment from a magnetic tape and plots an annotated track or plots the track and bathymetric or magnetic value perpendicular to the track as a profile. We use the format recommended by the National Research Council of the National Academy of Sciences with one slight modification for the input data tape. There is one logical record (of 80 characters) for each data point. The different types of data (navigation, bathymetry, and magnetics) are separated by an end-of-file mark with a double end-of-file mark at the end of all the data.

Before the program reads this input tape, it reads three cards. The first card specifies the minimum and maximum latitude and longitude in degrees and minutes. The second card specifies the kind of plot desired, the number of tick marks between the meridians and parallels, the spacing between the meridians and the parallels, the height of the map to be drawn, the dates of the data on the first input tape to be considered for plotting, the actual values to be plotted, and the units per inch for plotting the bathymetric or magnetic profiles along the track. The third card defines the actual data format on the input tape (the format varies for the three types of data).

With all the required parameters defined, the program starts to read the input tape one record at a time. Each record is checked to see that the fix falls on the defined grid and that it was taken on or between the two specified dates. Only those points which meet both requirements are plotted. The program continues reading the input tape until it reads an end-of-file mark or a fix taken after the last specified date. If there are additional input tapes, the program reads them in a similar manner. The beginning and end dates for each new input tape are required on an Extra card. A maximum of four input tapes can be used. When all the input tapes have been read, the program prepares to plot the track or annotated track and, if required, prepares to plot the profiling values for either bathymetry or magnetics.

The track is plotted on a Mercator projection which is drawn exactly to scale. The grid may be blown up to any reasonable size. Since the projection is drawn exactly to scale, a mosaic can later be built of the entire area.

2.1.1 Navigation Data

The program reads the date (month and day), time (hour and whole minutes), latitude, longitude, and fix number from the input tape according to the specified format. The southern latitudes and the western longitude are preceded by a negative sign. Normally, the track is plotted in a continuous line with every nth fix marked with a square symbol and annotated with the fix number.

2.1.2 Bathymetry Data

The program reads the date (month and day), time (hour and whole minutes), latitude, longitude, and uncorrected fathoms or corrected meters from the input tape according to the specified format. The southern latitudes and the western longitudes are preceded by a negative sign. The program can convert uncorrected fathoms to uncorrected meters. If an annotated track is desired, each fix is plotted with a small plus *symbol* and annotated with uncorrected fathoms, meters, or corrected meters. If a profile is desired, the track is plotted in a continuous straight line, and the profiling series is multiplied by -1 to drop it below the track.

2.1.3 Magnetic Data

The program reads the date (month and day), time (hour, and whole minutes), latitude, longitude, and residual magnetic intensity from the input tape according to the specified format. The southern latitudes and the western longitudes are preceded by a negative sign. If an annotated track is desired, each fix is plotted with a small plus *symbol* and annotated with the residual magnetic intensity. If a profile is desired, the track is plotted in a continuous straight line, and the profiling series is residual magnetic intensity.

2.2 Problem Background

This program allows the researcher to plot vast numbers of bathymetric and/or magnetic data on a Mercator chart. There are two ways of plotting the data: plot an annotated track (data value plotted according to geographical coordinates) or plot a profile of the data using the track as a reference point.

3.0 USAGE

3.1 Calling Sequence or Operation Procedure

Not applicable.

3.2 Arguments, Parameters, and/or Initial Conditions

Not applicable.

3.3 Space Required (Decimal and Octal)

3.3.1 Unique Storage:
7074 octal (3644 decimal) locations exclusive of system library functions.

3.3.2 Common Blocks:
/MAPSYS/, /INPT/, /RATCOM/, /CHTLBL/.

3.3.3 Temporary Storage:

None.

3.4 Messages and Instructions to the Operator

None.

3.5 Error Return, Messages, and Codes

Insufficient information to complete plot.

3.6 Informative Messages to the User

None.

3.7 Input

The actual format of the data on the input tape, the kind of plot desired, and the map specifications are read in via input cards. The track and the actual data to be annotated or profiled is read in via magnetic tape on logical units 10 through 13. Appendix A presents samples of our data formats on the input tape. Appendix B is a complete description of the input deck setup.

3.8 Output

The program prints on the standard printer (logical unit 61) the data format, chart parameters, and the actual number of points plotted for the track and profile. It writes the plotting instructions on a magnetic tape (logical unit 40). Appendix C presents sample profiles.

3.9 Formats

Appendix B describes the program deck structure.

3.10 External Routines and Symbols

SKIPFILE, PLOT, SQRTF, SINF, LOGF, COSF, TANF, ATANF, ACOSF, NUMBER, SYMBOL, XMODF.

3.11 Timing

The time required depends on the size of the grid and the number of data read and plotted.

3.12 Accuracy

The grid is reproduced exactly to scale.

3.13 Cautions to Users

None.

3.14 Program Deck Structure

Appendix B describes the program deck structure.

3.15 References — Literature

N. Maddage and S.J. Kozloski, Program Seachart, Naval Research Laboratory, Washington, D.C. M.L. Blodgett and J.V. Massingill, "A Program for Storing Oceanographic Data on Magnetic Tape," NRL Report 7861, March 1975.

4.0 METHOD OF ALGORITHM

Not applicable.

5.0 FLOW CHART AND/OR SOURCE LANGUAGE LISTING

The flow chart and listing are given in Appendixes D and E.

6.0 COMPARISON

No other known programs are available for comparison.

7.0 TEST METHOD AND RESULTS

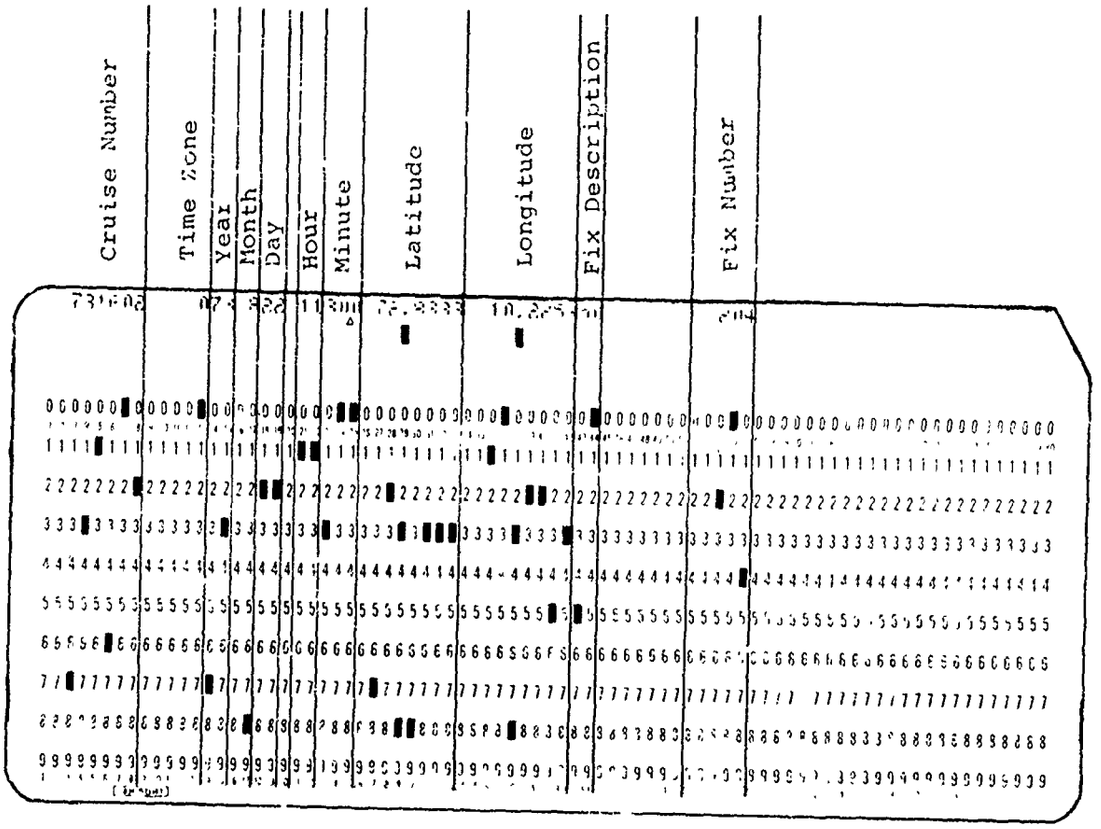
The program has been used and tested successfully on a Calcomp Plotter.

8.0 REMARKS

None.

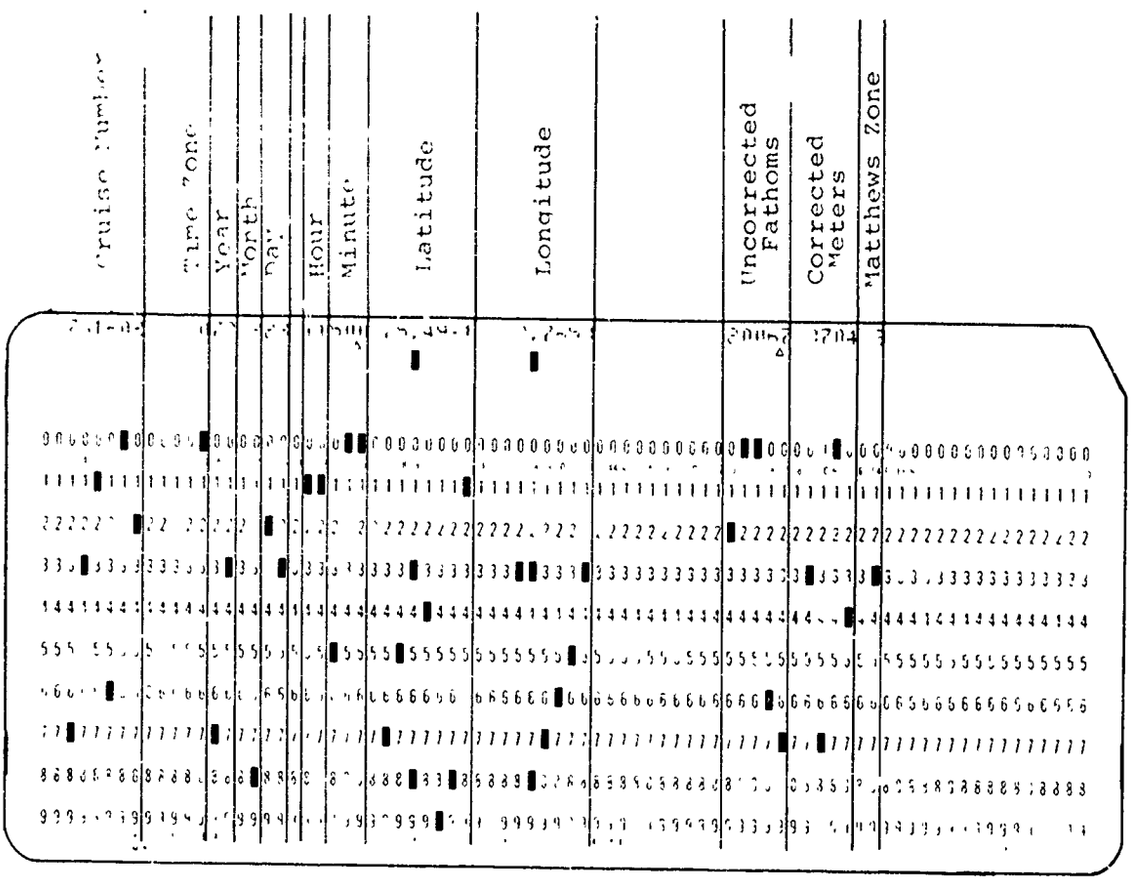
APPENDIX A
Sample Input Data Record

NAVIGATION RECORD



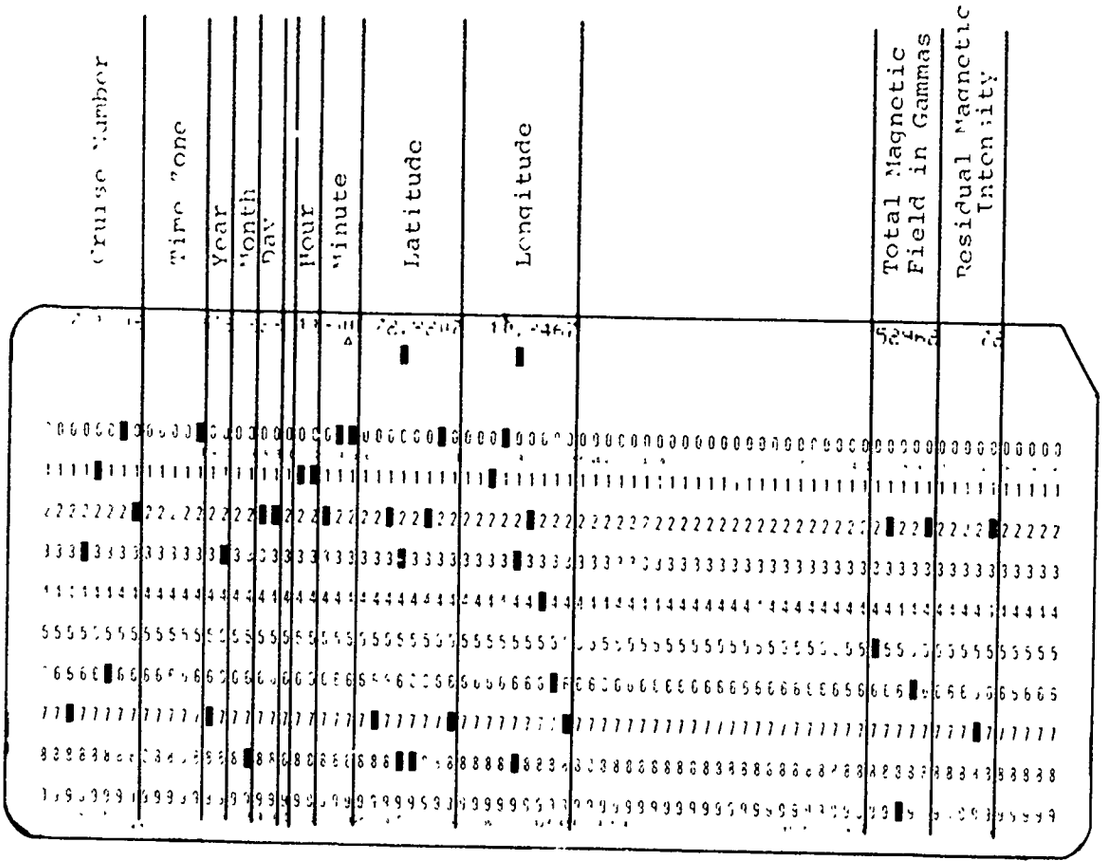
[a]Implies a decimal point.

BATHYMETRY RECORD



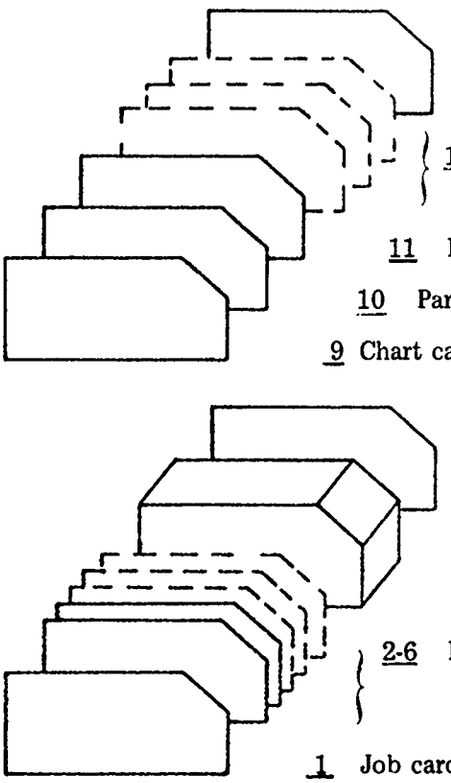
[Δ]Implies a decimal point.

MAGNETICS RECORD



[Δ]Implies a decimal point.

APPENDIX B
Deck Assembly for Program Mercator



13 End of File card

12 Extra card (one for each additional input tape)

11 Format card

10 Parameter card

9 Chart card

8 Run card

7 Program Mercator (binary deck)[2]

2-6 Equip cards[1] (logical units 10, 11, 12, 13, and 40)

1 Job card

---

[1]The program uses a scratch tape on logical unit 05, but no Equip card is required, since the drum is used.

[2]If the Fortran source deck is used instead of the binary deck, a Fortran card is required after the Equip card. In addition, a Scope card and Load card must follow the source deck.

Number	Card Title	Column Number	Description
1	Job	1-21	7/9 JOB, Charge No., ID No., time. See page 2-2 of the 3600/3800 Computer System Drum Scope Manual.
2-6	Equip	1-18	7/9 EQUIP, 40=**, WO, LO 7/9 EQUIP, 10=**, RO, HI 7/9 EQUIP, 11=**, RO, HI 7/9 EQUIP, 12=**, RO, HI 7/9 EQUIP, 13=**, RO, HI 10, 11, 12, 13, 40 = logical unit numbers. RO = read only. LO = low density. WO = write only. HI = high density. See page 2-3 of the 3600/3800 Computer System Drum Scope Manual.
7	Program	Deck of Mercator	This is the main program with associated subroutines. If the Fortran source deck is used instead of the binary deck, a Fortran card is required after the Equip card. The Fortran card reads 7/9 FTN, L, R, X. In addition a Scope card with SCOPE starting in Column 10 and a Load card must follow the source deck.
8	Run	1-13	7/9 RUN, T, P, R, M, D T = time limit in minutes. P = maximum number of print or write operations R,M,D may be left blank. See page 2-15 of the 3600/3800 Computer System Drum Scope Manual.
9	Chart	1-5	28.0 Degree portion of southernmost latitude for the chart (28°30'N). (If the latitude were 28°30'S, a minus sign would precede 28.0.)
		6-10	30.0 Minute portion of southernmost latitude (28°30'N).

Number	Card Title	Column Number	Description
		11-15	35.0 Degree portion of northernmost latitude. (A minus sign would indicate the latitude is south.)
		16-20	0.0 Minute portion of northernmost latitude. (Both degrees and minutes must be specified in decimal form even if a zero value is assigned.)
		21-26	-45.0 Degree portion of westernmost longitude for the chart (45°10'W). (The minus sign indicates the longitude is west.)
		27-30	10.0 Minute portion of westernmost longitude.
		31-36	-40.0 Degree portion of easternmost longitude (40°25'W).
		37-40	25.0 Minute portion of easternmost longitude.
10	Parameter	1-5	4000 (right justified). Units per inch for plotting values along the track. In this example a value of 4000 gammas would be plotted 1 inch above the track. The remainder of the profiling data would be scaled accordingly.
		7-8	60 Number of tick marks between the meridians.
		9-10	40 Number of tick marks between the parallels.

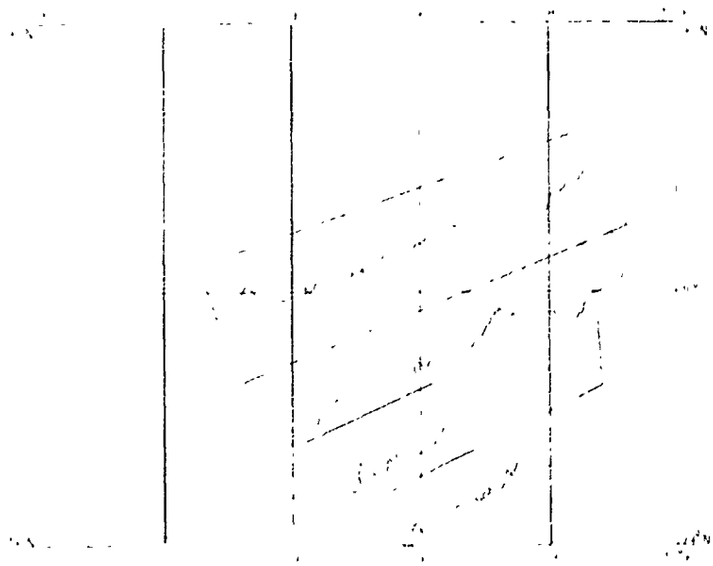
Number	Card Title	Column Number	Description
		12	0, 1, or 2 0 = every fix will be plotted with a + symbol and annotated. 1 = the track will be plotted in a continuous line and every nth fix (columns 20-24) will be marked with a small square and annotated. 2 = plot value series as a profile perpendicular to the track.
		14	0 or 1 0 = use value as read from the input tape. 1 = read uncorrected fathoms from the input tape and convert to uncorrected meters.
		16	0 or 1 0 = do not multiply the profiling series by -1. 1 = multiply the profiling series by -1 to drop it below the track.
		19	0, 1, or 2 Number of files to be skipped over on the first input tape. There are a maximum of three files on our Geodata tapes.
		20-24	12 (right justified). This value designates the n of the nth fix to be annotated. This value is specified only if there is a 1 in column 12.
		26-30	5.0 Degree portion of the interval between the meridians.
		31-35	0.0 Minute portion of the interval between the meridians. (Both degrees and minutes must be specified in decimal form even if a zero value is assigned.) In this example the spacing will be at 5-degree intervals.

Number	Card Title	Column Number	Description
		36-40	10.0 Degree portion of the interval between the parallels.
		41-45	0.0 Minute portion of the interval between the parallels. In this example the spacing will be at 10-degree intervals.
		56-60	9.00 Physical height of the chart to be drawn.
		64	1, 2, 3, or 4 Number of input tapes, with the maximum being four.
		65-72	02250330 Date and time of the first data point to be read and plotted from the first input tape. Columns 65 and 66 are for the month, columns 67 and 68 are for the day, columns 69 and 70 are for the hour, and columns 71 and 72 are for the minutes.
		73-80	02280830 Date and time of the last data point to be read and plotted from the first input tape. All data between the date and time of the first data point and of the last data point will be read and plotted if it falls on the defined chart.
11	Format	1-?	(15XI4, 1XI4, 1XF8.4, F9.4, 10XF5.1) This format should be replaced by the desired input format. The format must be enclosed in parentheses and left-justified. Via this format the program reads the date (month and day), time (hour and whole minutes), latitude, longitude, and value to be annotated or profiled (fix number of navigation, uncorrected fathoms or corrected meters

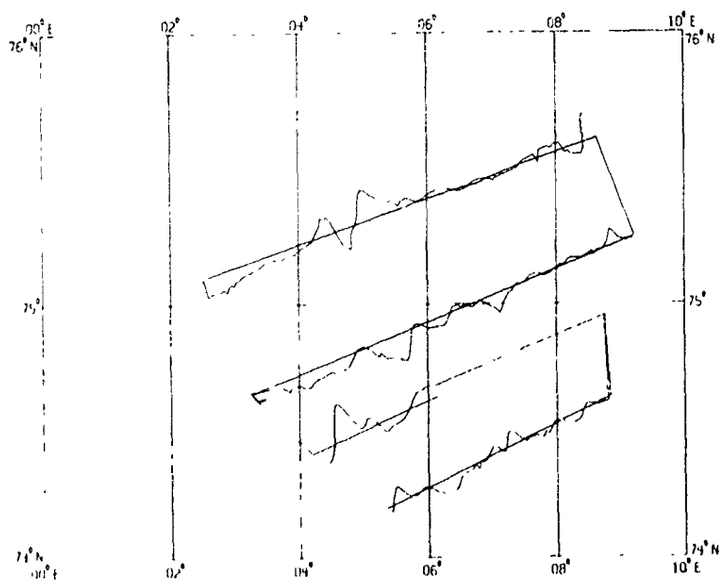
Number	Card Title	Column Number	Description
			for bathymetry, and residual magnetic intensity for magnetics). The formats for reading the three data types on our input tapes are: • Navigation (15XI4, 1XI4, 1XF8.4, F9.4, 9XF5) • Bathymetry – uncorrected fathoms (15XI4, 1XI4, 1XF8.4, F9.4, 10XF5.1) • Magnetics (15XI4, 1XI4, 1XF8.4, F9.4, 28XF5).
12	Extra	1-4	0, 1, or 2 Number of files to be skipped over on the second input tape. There must be an Extra card for each additional input tape. Since there is a maximum of four input tapes, the maximum number of Extra cards is three.
		5-12	02250330 Date and time of the first data point to be read and plotted from the second input tape. The dates for the first input tape are on the Map Parameter Card.
		13-20	02280830 Date and time of the last data point to be read and plotted from the second input tape.
13	End of File		Terminates the run.

APPENDIX C
Sample Profiles

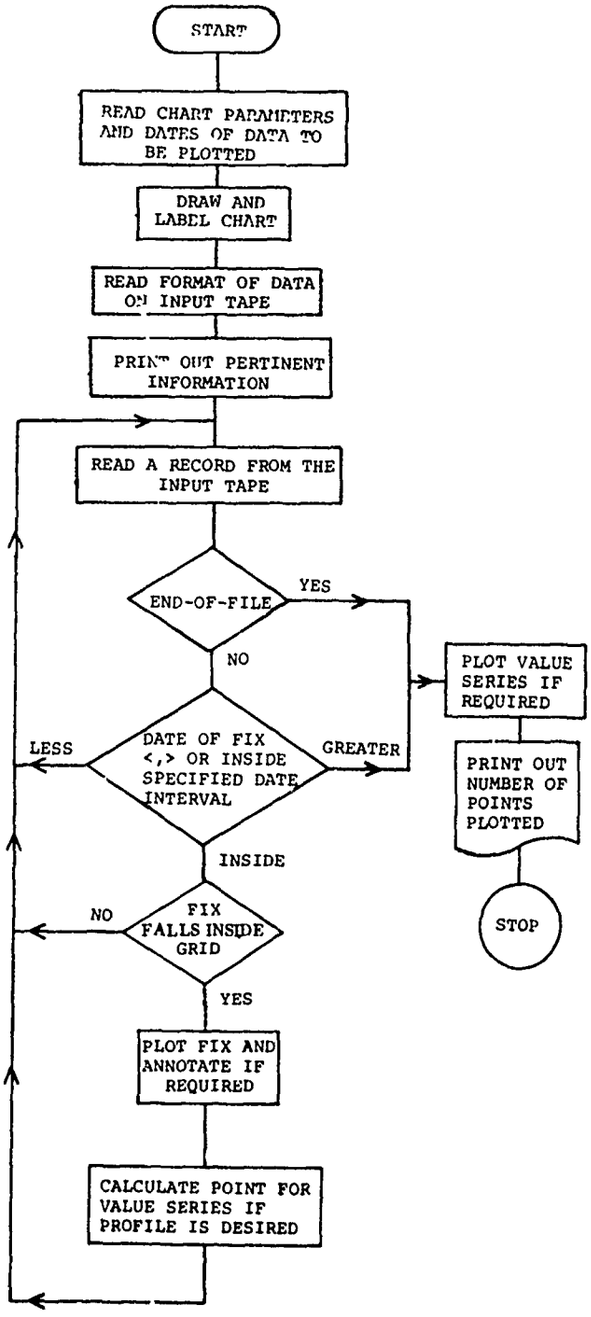
BATHYMETRY PROFILE



MAGNETIC PROFILE



APPENDIX D
Flow Chart



APPENDIX E
Source Language Listing

```
      PROGRAM MERCATOR
      REAL LAT
      REAL LATMIN,LATMAX,LONGMIN,LONGMAX
      DIMENSION IBLF(254),ANGH(2),HEAD(2),S(2)
      DIMENSION IPM(10)
      COMMON/MAPSYS/    CORR(4),     RR,          DEL,         ACHT,          800
     1                  IPR,         XMIN,        YMIN,        XMAX,          900
     2                  YMAX,        MP,          ICR,         IA,           1000
     3                  RAHI,        RAHI                                    1100
C                                                                             1200
      COMMON/INPT/ALATND,  ALATNM,  ALATNS,  ALATXD,  ALATXM,  ALATXS,       1300
     1            ALOGND,  ALOGNM,  ALOGNS,  ALOGXD,  ALOGXM,  ALOGXS,       1400
     2            MPC,     KOMP,    WIDTH,   HITE,    DEGDVD,  DEGDVM,       1500
     3            DEGDVS,  NTIC,    TICLGT,  ALTMD(5),ALTMM(5),ALTMS(5),     1600
     4            ALNMD(5),ALNMM(5),ALNMS(5),ALTSD(5),ALTSM(5),ALTSS(5),     1700
     5            ALNSD(5),ALNSM(5),ALNSS(5),AR(5),   VR(5)                  1800
C                                                                             1900
      COMMON/RATCOM/NAVSYS,   NORATE,   RATID(5), CDLY(5),  RATINC(5),        2000
     1    ARAT(5),  PHIM(5),  ALAM(5),  PHIS(5),  ALAS(5),  KNTMAX,          2100
     2    KNT,      EPS,      NR,       DELT,     DSLN(5)                    2200
C                                                                             2300
      COMMON/CHTLBL/MINMER,   MNMER(50),MAXMER,   MINPAR,   MNPAR(50),       2400
     1              MAXPAR,   NC,       NNC(50),  NTC,      NLY,           2500
     2              NY(50),   NRY,      XL(50),   YK(50),   KXAXIS,        2600
     3              KYAXIS,   IYN,      NI,       XTIB,     YTIB,          2700
     4              LYN                                                     2800
      COMMON/FIXGRAT/DDL,NTIX
C                                                                             2900
      LP = 0                                                                  3000
      IFIRST=0
      KOUNT=1
      IA = 1                                                                 83200
      IPR = 61                                                               83300
      ICR = 60                                                               83400
      IEX=0
      IT=10
      IUP=3
      ALATNS=0.0
      ALATXS=0.0
      ALOGNS=0.0
      ALOGXS=0.0
      DEGDDS=0.0
      DEGDVS=0.0
      PI=3.14159
      KOMP=1
      NAVSYS=1
      NORATE=0
      IYN=0
      LYN=1
      MPC=1
C     READ IN RANGE OF CHART                                                  83500
      READ(60,101)ALATND,ALATNM,ALATXD,ALATXM,ALOGND,ALOGNM,ALOGXD,
     1ALOGXM
  101 FORMAT(4F3.1,F6.1,F4.1,F6.1,F4.1)
   10 READ(ICR,601)GINCH,NTIC,NTIX,ILINE,IUSE,IMULT,ITAPE,IPT,DEGDVD,DEGDVM,DEGD
     2DVM,
```

```
     .1DEGDDD,DEGDDM,WITE,NOTP,JUDY1,ITM1,JUDY2,ITM2
  601 FORMAT(F5.1X,512,I3,I5,1XF5.1,3F5.1,10XF5.2,5I4)
      DO 777 IX=1,ITAPE
  777 CALL SKIPFILE(IT)
      GO TO(20,800)IA                                                    3200
   20 RR=0.9966329966
      NS = 8                                                             75300
C**** CONVERT DEGREES, MINUTES AND SECONDS TO RADIANS                    75400
      CALL DTOR(ALATND,ALATNM,ALATNS,CORR(1))                            75500
      CALL DTOR(ALATXD,ALATXM,ALATXS,CORR(2))                            75600
      CALL DTOR(ALOGND,ALOGNM,ALOGNS,CORR(3))                            75700
      CALL DTOR(ALOGXD,ALOGXM,ALOGXS,CORR(4))                            75800
      CALL DTOR(DEGDVD,DEGDVM,DEGDVS,DEL)                                75900
      CALL DTOR(DEGDDD,DEGDDM,DEGDDS,DDL)
      CALL PLOTS(IBUF,254,4,29)
      CALL PLOT(0.0,0.0,3)
C**** MERCAT IS THE SUBROUTINE NAME FOR MERCATOR PROJECTION               3700
  100 CALL MERCAT                                                        3800
      IF(WIDTH.LE.0.0.OR.HITE.LE.0.0)GO TO 800                           3900
  700 CALL GRATIE                                                        6200
      IF(NTIC)715,715,710
  710 CALL TICX
  715 IF(NTIX)26,26,717
  717 CALL TICY
   26 CALL CHLABEL
   25 M=1
      AMIN=0.0
      SEC=0.0
      MINUS=4000000000000000B
      XLAM=ABSF(ALATNM)
      KOY=ALATND.AND.MINUS
      IF(KOY.EQ.MINUS)27,28
   27 LATMIN=ALATND-XLAM/60.0
      GO TO 29
   28 LATMIN=ALATND + XLAM/60.0
   29 XLAM=ABSF(ALATXM)
      KOY=ALATXD.AND.MINUS
      IF(KOY.EQ.MINUS)30,31
   30 LATMAX=ALATXD-XLAM/60.0
      GO TO 32
   31 LATMAX=ALATXD + XLAM/60.0
   32 XLAM=ABSF(ALOGNM)
      KOY=ALOGND.AND.MINUS
      IF(KOY.EQ.MINUS) 33,34
   33 LONGMIN=ALOGND-XLAM/60.0
      GO TO 35
   34 LONGMIN=ALOGND + XLAM/60.0
   35 XLAM=ABSF(ALOGXM)
      KOY=ALOGXD.AND.MINUS
      IF(KOY.EQ.MINUS)36,37
   36 LONGMAX=ALOGXD-XLAM/60.0
      GO TO 38
   37 LONGMAX=ALOGXD+ XLAM/60.0
   38 READ(60,1000)IFM
 1000 FORMAT(10A8)
      WRITE(61,555)IFM
  555 FORMAT(*  DATA FORMAT ...*,10A8)
      WRITE(61,1010)
 1010 FORMAT(1H0,16HCHART PARAMETERS)
      WRITE(61,1011)LATMIN,LATMAX
 1011 FORMAT(1H ,20HSOUTHERMOST LATITUDE  ,F10.2,10X20HNORTHMOST LATITUDE
     1 ,F10.2)
      WRITE(61,1012)LONGMIN,LONGMAX
```

```
1012 FORMAT(1H ,2(HWESTMOST LONGITUDE  ,F10.2,10X2OHEASTMOST LONGITUDE
    1 ,F10.2)
     MM=3
     IOP=2
7400 READ(IT,IFM)IDAY,ITIME,RLAT,RLONG,ANOMAL
     IF(IOCHECK,IT)7400,7051
7051 IF(EOF,IT)1002,1001
7401 IUP=3
     GO TO 7400
1001 IF(IDAY,LT,JLDY1) GO TO 7401
     IF(IDAY,GT,JLDY2) GO TO 1002
     IF(IDAY,EQ,0) GO TO 1002
     IF(IDAY,EQ,JLDY1,AND,ITIME,LT,ITM1) GO TO 7401
     IF(IDAY,EQ,JLDY2,AND,ITIME,GT,ITM2)GO TO 1002
     IF(RLAT,LT,LATMIN) GO TO 7401
     IF(RLAT,GT,LATMAX) GO TO 7401
     IF(RLONG,LT,LONGMIN) GO TO 7401
     IF(RLONG,GT,LONGMAX) GO TO 7401
     ITRAK=ITRAK + 1
     CALL DTOR(RLAT  ,AMIN,SEC,RRLAT)
     CALL DTOR(RLONG ,AMIN,SEC,RRLONG)
     CALL MERCTR(C,AORT,RR,RRLAT,RRLONG,XDIM,YDIM)
     IF(IUSE,EQ,1)609,610
609  ANOMAL=ANOMAL+1.8288
610  IF(IMULT,EQ,1)611,608
611  ANOMAL=-ANOMAL
608  IF(IFIRST)8001,8000,8001
8000 XLAST=XDIM
     YLAST=YDIM
     S(1)=XDIM
     S(2)=YDIM
     IFIRST=1
     CALL PLOT(XDIM,YDIM,3)
8001 ANOM(1)=ANOM(2)
     ANOM(2)=ANOMAL
     IF(IFIRST,EQ,1) 503,504
503  XDIFF=XDIM-S(1)
     YDIFF=YDIM-S(2)
     IFIRST=2
     GO TO 15
504  XDIFF=(XDIFF + (XDIM-S(1)))/2
     YDIFF=(YDIFF + (YDIM - S(2)))/2
15   HEAD(2)=ATAN2(YDIFF,XDIFF)
     IF(HEAD(2),LT,0)HEAD(2)=2*PI+HEAD(2)
     IF(0.,LE,HEAD(2))411,408
411  IF(HEAD(2),LE,PI/2)407,408
407  ISIGN=1
     GO TO 23
408  IF(3.*PI/2.,LT,HEAD(2))412,410
412  IF(HEAD(2),LT,2.*PI)409,410
409  ISIGN=1
     GO TO 23
410  ISIGN=-1
23   XONE=S(1)+ISIGN*ANOM(1)*SIN(HEAD(2))/GINCH
     XTWO=S(2)+ISIGN*ANOM(1)*COS(HEAD(2))/GINCH
     IF(ILINE,EQ,2) 605,606
605  WRITE(05,700) XONE,XTWO,IUP
700  FORMAT(2F10.4,I1)
```

```
606   S(1)=XDIM
      S(2)=YDIM
      WEAD(1)=HEAD(2)
      CALL ANGAN0(XDIM,XLAST,YDIM,YLAST,ANG)
      CALL FIXAN0(XDIM,YDIM,ANG,AN0MAL,K0UNT,ILINE,IPT,IUP)
      K0UNT=K0UNT + 1
      XLAST=XDIM
      YLAST=YDIM
      G0 T0 7400
1002  IEX=IEX + 1
      REWIND IT
      IF(N0TP.EQ.IEX) G0 T0 999
      IT=IT + 1
      READ(ICR,997)ITAPE,JUDY1,ITM1,JUDY2,ITM2
997   F0RMAT(5I4)
      D0 998 IX=1,ITAPE
998   CALL SKIPFILE(IT)
      MM=3
      I0P=2
      IUP=3
      G0 T0 7400
999   IF(ILINE.EQ.2)607,800
607   REWIND 05
1003  READ(05,700)X0NE,XTW0,IUP
      IF(I0CHECK,05)1003,508
508   IF(E0F,05)80C,801
801   IAN0M=IAN0M + 1
      IF(IFIRST.EQ.2) 505;506
505   CALL PL0T(X0NE,XTW0,3)
      IFIRST=3
506   CALL PL0T(X0NE,XTW0,IUP)
      G0 T0 1003
800   CALL PL0TS(0,0)
      CALL ST0PPL0T
      WRITE(61,1020)ITRAK
1020  F0RMAT(1H0,15HPR0GRAM PL0TTED, I8,5X19HFIXES F0R THE TRACK)
      IF(ILINE.NE.2) G0 T0 1015
      WRITE(61,1021)IAN0M
1021  F0RMAT(1H0,15HPR0GRAM PL0TTED, I8,5X22HP0INTS F0R THE PR0FILE)
1015  ST0P
      END
```

```
                                        IDENT     MERCATOR
PROGRAM LENGTH                  01743
ENTRY POINTS      MERCATOR      00565
BLOCK NAMES
                  MAPSYS        00021
                  INPT          00133
                  RATCOM        00064
                  CHTLBL        00473
                  FIXCRAT       00002
EXTERNAL SYMBOLS
                  Q8CENTRY
                  THEND,
                  Q8C04100
                  Q8CSTOPS
                  Q8CDICT,
                  SKIPFILE
                  DTCR
                  PUCTS
                  PUCT
                  MERCAT
                  GRATIC
                  TICX
                  TICY
                  CHLABEL
                  MERCTR
                  ANGANG
                  FIXANG
                  STCPPUCT
                  ATAN2
                  SINF
                  COSF
                  Q8CIFECF
                  Q8CIFICC
                  REW,
                  TSK,
                  STK,
                  SUC,
                  SLI,
                  CNSINGL
  00450 SYMBOLS
```

```
      SUBROUTINE GRATIE                                                    60000
C                                                                          60100
C*************************************************************************60200
C *                                                                       60300
C * THIS SUBROUTINE STORES VALUES IN AN ARRAY THAT ARE USED FOR PLOTTING   60400
C * BORDER AND GRATICULE FOR A MERCATOR AND INVERSE MERCATOR PROJECTION    60500
C * CHART,  NOTE, USER DOCUMENTATION FOR EXPLANATION OF INVERSE MERCATOR,  60600
C *                                                                       60700
C*************************************************************************60800
C                                                                          60900
      COMMON/MAPSYS/    CORR(4),      RR,           DEL,          ACHT,    61000
     1                  IPR,          XMIN,         YMIN,         XMAX,    61100
     2                  YMAX,         MP,           ICR,          IA,      61200
     3                  RAW1,         RAW2                                 61300
C                                                                          61400
      COMMON/INPT/ALATND,  ALATNM,  ALATNS,  ALATXD,  ALATXM,  ALATXS,     61500
     1             ALONGD,  ALONGM,  ALONGS,  ALONGD,  ALONGM,  ALONGS,    61600
     2             NPC,     KOMP,    WIDTH,   HITE,    DEGDVD,  DEGDVM,    61700
     3             DEGDVS,  NTIC,    TICLGT,  ALTMD(5),ALTMM(5),ALTMS(5),  61800
     4             ALNMD(5),ALNMM(5),ALNMS(5),ALTSD(5),ALTSM(5),ALTSS(5),  61900
     5             ALNSD(5),ALNSM(5),ALNSS(5),AR(5),   VR(5)               62000
      COMMON/FIXGRAT/DEL,NTIX                                              
C                                                                          62100
C=========================BORDER=============*=============               62200
C                                                                          62300
      ONEDEG = 3.1415926535/180.0                                          62400
      CALL PLOT(XMIN,YMIN,3)                                               
      CALL PLOT(XMAX,YMIN,2)                                               
      CALL PLOT(XMAX,YMAX,2)                                               
      CALL PLOT(XMIN,YMAX,2)                                               
      CALL PLOT(XMIN,YMIN,2)                                               
      IF(DEL)900,900,100                                                   63000
  100 GO TO(110,110,910)MP                                                 
  110 LK = 3                                                               63200
      KL = 1                                                               63300
      NTRY = +1                                                            63400
  120 IF(DEL.LT.ONEDEG)NTRY = 1                                            63500
      TEMP = CORR(LK)/DEL                                                  
      ITEMP = TEMP+0.0001                                                  63700
      DIFF = ABSF(TEMP-ITEMP)                                              63800
      AINCR = DEL                                                          63900
      IF(DIFF.LT.DEL/20.0)GO TO 140                                        64000
      IF(CORR(LK).LT.0.0)GO TO 130                                         64100
      AINCR = DEL*(1.0-DIFF)                                               64200
      GO TO 140                                                            64300
  130 AINCR = DEL*DIFF                                                     64400
  140 ALCHK = CORR(LK+1)-AINCR/4.0                                         64500
      GO TO(150,160)KL                                                     64600
  150 ALONG = CORR(3)+AINCR                                                64700
      ISB = 1                                                              64800
      GO TO 170                                                            64900
  160 ALAT = CORR(1)+AINCR                                                 65000
      ISB = 3                                                              65100
  170 NP = 3                                                               65200
      ISW = 1                                                              65300
      KSW = 1                                                              65400
```

```
      GO TO(180,190)KL                                                  65500
180   CALL MERCTR(C,ACHT,RR,CORR(ISB),ALONG,XX,YY)
      CALL PLOT(XX,YY,NP)
      JSW = NP+1                                                        65800
      GO TO (185,200)JSW                                                65900
185   CALL CHFOLD(ALONG,XX,NTRY)                                        66000
      ALONG = ALONG+DEL                                                 66100
      IF(ALONG.LT.ALCHK)GO TO 200                                       66200
      LK = 1                                                            66300
      KL = 2                                                            66400
      NTRY = 2                                                          66500
      GO TO 220
190   CALL MERCTR(C,ACHT,RR,ALAT,CORR(ISB),XX,YY)
      CALL PLOT(XX,YY,NP)
      JSW = NP+1                                                        66900
      GO TO(195,200)JSW                                                 67000
195   CALL CHFOLD(ALAT,YY,NTRY)                                         67100
      ALAT = ALAT+DEL                                                   67200
      IF(ALAT.GT.ALCHK)GO TO 900                                        67300
200   IF(NP.NE.3)GO TO 210                                              67400
      ISB = ISB*KSW                                                     67500
      KSW = -1*KSW                                                      67600
210   ISW = -1*ISW                                                      67700
      NP = NP*ISW                                                       67800
      GO TO(180,190)KL                                                  67900
220   STDEL=DEL
      DEL=DDL
      IF(DEL)900,900,120
900   CALL PLOT(XMIN,YMIN,3)
910   DEL=STDEL
      RETURN
      END                                                               71400
```

```
                                  IDENT     GRATIE
PROGRAM LENGTH                00321
ENTRY POINTS     GRATIE       00003
BLOCK NAMES
                 MAPSYS       00021
                 INPT         00133
                 FIXGRAT      00002
EXTERNAL SYMBOLS
                 QUC10100
                 QUC03100
                 QUCDICT,
                 PLOT
                 MERCTR
                 CHFOLD
   00163 SYMBOLS
```

```
      SUBROUTINE CHSYM(LABEL,XDIM,YDIM,NCHAR,JSUB)                      31300
C                                                                       31400
      DATA(HH = 0,07),  (W = 0,08),  (H = 0,14),  (S = 0,04),           31500
C                                                                       31600
      ANC = 3,0                                                         31700
      IGO = XABSF(NCHAR)+JSUB                                           31800
      GO TO(10,20,50,10,20)IGO                                          31900
   10 ANC = ANC+1,0                                                     32000
   20 CALL SYMBOL(XDIM,YDIM,H,LABEL,0,0,8)                              32100
      X2 = XDIM+W*ANC+S*(ANC-1,0)+0,03                                  32200
      YH = YDIM+H                                                       32300
      IF(NCHAR,GT,0)GO TO 30                                            32400
      X3 = X2                                                           32500
      GO TO 40                                                          32600
   30 CALL SYMBOL(X2,YH,HH,1H0,0,0,1)                                   32700
      IF(NCHAR,LT,2)GO TO 50                                            32800
      X3 = X2+3,0*(W+S)                                                 32900
   40 CALL SYMBOL(X3,YH,HH,1H/,0,0,1)                                   33000
   50 RETURN                                                            33100
      END                                                               33200
```

```
                                IDENT     CHSYM
PROGRAM LENGTH              00174
ENTRY POINTS    CHSYM       00011
EXTERNAL SYMBOLS
                OSCDICT,
                SYMBOL
   00063 SYMBOLS
```

```
      SUBROUTINE BCDC0N(FLPTD,FLPTM,BCD,N0CH,NE)                        9800
      DATA(IBLNK = 6060606060606060B), (NOR = 45B), (IS0U = 62B),       9900
     1    (IEAS = 25B), (IWES = 66B)
      DIMENSION LTR(10)                                                 10000
C                                                                       10100
C,,,,                                                                   10200
      NEWS = XABSF(NE)                                                  10300
      LPTD = ABSF(FLPTD)                                                10400
      LPTM = FLPTM                                                      10500
      IF(NE.GT.0)GO TO 50                                               10600
      IF(LPTM.NE.0)GO TO 50                                             10700
      N0CH = 5                                                          10800
      ICAR = LPTD                                                       10900
      GO TO 60                                                          11000
   50 N0CH = 8                                                          11100
      ICAR = LPTD*1000+LPTM                                             11200
   60 IF(LPTD.LT.100)N0CH = N0CH-1                                      11300
      DO 5 LZ=1,N0CH                                                    11400
    5 LTR(LZ) = 0                                                       11500
      NCHAR = N0CH*2                                                    11600
      CALL BULAB(ICAR,NCHAR,LTR(1))                                     11700
      KK = N0CH+1                                                       11800
      DO 10 JJ=KK,8                                                     11900
   10 LTR(JJ) = IBLNK                                                   12000
      IF(N0CH.GT.6)LTR(N0CH-4)=IBLNK                                    12100
      GO TO(20,30)NEWS                                                  12200
   20 K0MP = IEAS                                                       12300
      IF(FLPTD.LT.0.0)K0MP = IWES                                       12400
      GO TO 40                                                          12500
   30 K0MP = NOR                                                        12600
      IF(FLPTD.LT.0.0)K0MP = IS0U                                       12700
   40 LTR(N0CH) = K0MP                                                  12800
      CALL APACK(N0CH,LTR(1),BCD)                                       12900
      RETURN                                                            13000
      END                                                               13100
                                                                        13200
```

```
PROGRAM LENGTH          00276   IDENT    BCDC0N
ENTRY POINTS    BCDC0N  00022
EXTERNAL SYMBOLS
                01C10100
                08CDICT,
                BULAB
                APACK
  00120 SYMBOLS
```

```
      SUBROUTINE CENTR(MC,DL0C,DTLL)                                    14400
      COMMON/CHTLBL/MINMER,   MNMER(50),MAXMER,   MINPAR,   MNPAR(50),  14500
     1              MAXPAR,   NC,       NNC(50),  NTC,      NLY,        14600
     2              NY(50),   NRY,      XL(50),   YK(50),   KXAXIS,     14700
     3              KYAXIS,   IYN,      NI,       XTIB,     YTIB,       14800
     4              LYN                                                14900
C                                                                       15000
      DATA(WID = 0.08), (SP = 0.04)                                     15100
C                                                                       15200
      DTLL = (WID+SP)*NC-SP                                             15300
      DL0C=DTLL/2.0                                                     15400
      RETURN                                                            15500
      END                                                               15600
```

```
                                    IDENT     CENTR
PROGRAM LENGTH              00064
ENTRY POINTS    CENTR       00005
BLOCK NAMES
                CHTLBL      00473
EXTERNAL SYMBOLS
                01C04100
                08CDICT,
   00052 SYMBOLS
```

```
      SUBROUTINE CHLABEL                                                    22600
      COMMON/MAPSYS/     CORR(4),     RR,          DE,          ACHT,      22700
     1                   IPR,         XMIN,        YMIN,        XMAX,      22800
     2                   YMAX,        MP,          ICR,         IA,        22900
     3                   RAWI,        RAWI                                 23000
      COMMON/INPT/ALATND, ALATNM, ALATNS, ALATXD, ALATXM, ALATXS,           23100
     1            ALOGND, ALOGNM, ALOGNS, ALOGXD, ALOGXM, ALOGXS,           23200
     2            INDTUSE(79)                                               23300
      COMMON/CHTLBL/MINMER, MNMER(50),  MAXMER, MINPAR, MNPAR(50),          23400
     1              MAXPAR, NC,         NNC(50), NTC,     NLY,            23500
     2              NY(50), NRY,        XL(50),  YK(50),  KXAXIS,         23600
     3              KYAXIS, IYN,        NI,      XTIB,    YTIB,           23700
     4              LYN                                                     23800
      DATA(NO = 8), (HH = 0.07)                                             23900
C....                                                                       24000
      ONEDEG = 3.1415926535/180.0                                           24100
      NMIN = -1                                                             24200
      IF(DEL.LT.ONEDEG)NMIN = 1                                             24300
      LNG = NMIN+1                                                          24400
      LTD = NMIN+2                                                          24500
      CALL BCDCON(ALOGND,ALOGNM,MINMER,NC,LNG)                              24600
      CALL BCDCON(ALOGXD,ALOGXM,MAXMER,NTC,LNG)                             24700
      CALL BCDCON(ALATND,ALATNM,MINPAR,NLY,LTD)                             24800
      CALL BCDCON(ALATXD,ALATXM,MAXPAR,NRY,LTD)                             24900
C                                                                           25000
C....   SET UP MINIMUM MERIDIAN LABEL                                       25100
      Y1 = YMIN+0.265                                                       25200
      KNT = 0                                                               25300
  100 CALL CENTR(NC,HTLL,TLL)                                               25400
      X1 = XMIN+HTLL                                                        25500
      KI = 0                                                                25600
      KNT = KNT+1                                                           25700
      CALL CHSYM(MINMER,X1,Y1,NC,3)                                         25800
C                                                                           25900
C....   SET UP INTERMEDIATE MERIDIAN LABELS                                 26000
  120 KI = KI+1                                                             26100
      KN = XABSF(NNC(KI))                                                   26200
      CALL CENTR(KN,HTLL,TLL)                                               26300
      X1 = XL(KI)-TLL                                                       26400
      CALL CHSYM(MNMER(KI),X1,Y1,NNC(KI),1)                                 26500
  140 IF(KI.LT.KXAXIS)GO TO 120                                             26600
C                                                                           26700
C....   SET UP MAXIMUM MERIDIAN LABEL                                       26800
  150 CALL CENTR(NTC,HTLL,TLL)                                              26900
      X1 = XMAX-HTLL                                                        27000
      CALL CHSYM(MAXMER,X1,Y1,NTC,3)                                        27100
      GO TO(160,180)KNT                                                     27200
```

```
C
C....  SET UP FOR UPPER BORDER                                          27300
  160 Y1 = YMAX+0.055                                                   27400
      GO TO 100                                                         27500
C                                                                       27600
C....  SET UP FOR MINIMUM PARALLEL LABEL                                27700
C        FIND X1 FOR LEFT BORDER                                        27800
  180 CALL CENTR(NLY,HTLL,TLL)                                          27900
      KNT = 0                                                           28000
      X1 = XMIN-(TLL+0.055)                                             28100
  200 Y1 = YMIN                                                         28200
      KY = 0                                                            28300
      KNT = KNT+1                                                       28400
      CALL CHSYM(MINPAR,X1,Y1,NLY,3)                                    28500
C                                                                       28600
C....  SET UP INTERMEDIATE PARALLEL LABELS                             28700
  220 KY = KY+1                                                         28800
      Y1 = YK(KY)-HH                                                    28900
      GO TO(230,240)KNT                                                 29000
C        FIND X1 FOR LEFT BORDER                                        29100
  230 KN = XABSF(NY(KY))                                                29200
      CALL CENTR(KN,HTLL,TLL)                                           29300
      X1 = XMIN-(TLL+0.125)                                             29400
  240 CALL CHSYM(MAPAR(KY),X1,Y1,NY(KY),1)                              29500
  260 IF(KY.LT.KYAXIS)GO TO 220                                         29600
C                                                                       29700
C....  SET UP MAXIMUM PARALLEL LABEL                                    29800
  280 Y1 = YMAX+0.21                                                    29900
      GO TO(290,300)KNT                                                 30000
C        FIND X1 FOR LEFT BORDER                                        30100
  290 CALL CENTR(NRY,HTLL,TLL)                                          30200
      X1 = XMIN-(TLL+0.055)                                             30300
  300 CALL CHSYM(MAXPAR,X1,Y1,NRY,3)                                    30400
      GO TO(320,350)KNT                                                 30500
C                                                                       30600
C....  SET UP FOR RIGHT BORDER                                          30700
  320 X1 = XMAX+0.055                                                   30800
      GO TO 200                                                         30900
  350 RETURN                                                            31000
      END                                                               31100
                                                                        31200
```

```
                                        IDENT     CHLABEL
PROGRAM LENGTH                  00311
ENTRY POINTS      CHLABEL       00005
BLOCK NAMES
                  MAPSYS        00021
                  INPT          00133
                  CHTLBL        00473
EXTERNAL SYMBOLS
                  OSCDICT,
                  BOLCON
                  CENTR
                  CHSYM
   00141 SYMBOLS
```

```
      SUBROUTINE APACK(NCHS,STRING,OUTLAB)                              8100
      DIMENSION STRING(NCHS),OUTLAB(1)                                  8200
      ENCODE(8,101,OUTLAB)(STRING(I),I=1,NCHS)                          8300
      RETURN                                                            8400
  101 FORMAT(8R1)                                                       8500
      END                                                               8600
```

```
                                  IDENT    .APACK
PROGRAM LENGTH                00075
ENTRY POINTS    APACK         00006
EXTERNAL SYMBOLS
                THEND,
                OBCDICT,
                ENC,
                ONSINGL.
   00035 SYMBOLS
      SUBROUTINE CHTOLB(CORAD,ALOC,NTRY)                                15700
      COMMON/INPT/ALAND,    DUMMY(5),    ALGGND,     DUMEE(84)        15800
      COMMON/CHTLBL/MINMER, MNMER(50)    MAXMER,  MINPAR,  MNPAR(50),  15900
     1              MAXPAR,  NC,          NNC(50), NTC,     NLY,      16000
     2              NY(50),  NRY,         XL(50),  YK(50),  KXAXIS,   16100
     3              KYAXIS,  IYN,         NI,      XYIB,    YYIB,     16200
     4              LYN                                               16300
      DIMENSION LTT(10)                                                 16400
      DATA(IBLNK = 6060606060606060B)                                   16500
C                                                                       16600
      KGO = XABSF(NTRY)                                                 16700
      GO TO(10,20,30)KGO                                                16800
   10 KORGLD = ABSF(ALGGND)                                             16900
      IF(CORAD,LT,C,0)KORGLD = KORGLD+1                                 17000
      IK = 1                                                            17100
      KRT = NTRY                                                        17200
      NTRY = 3                                                          17300
      IAX = 1                                                           17400
      KXAXIS = 0                                                        17500
      GO TO 30                                                          17600
   20 KORGLD = ABSF(ALANND)                                             17700
      IF(CORAD,LT,C,0)KORGLD = KORGLD+1                                 17800
      IK = 1                                                            17900
      NTRY = 3                                                          18000
      IAX = 2                                                           18100
      KYAXIS = 0                                                        18200
   30 CALL RTODM(CORAD,KORDG,CORMN)                                     18300
      KORMN = CORMN                                                     18400
      KORDG = XABSF(KORDG)                                              18500
      IF(KORDG,EQ,KORGLD,AND,KORMN,NE,0)GO TO 40                        18600
      NK = 6                                                            18700
      IF(KORDG,LT,100)NK = NK+1                                         18800
      KORGLD = KORDG                                                    18900
      IF(KRT,LT,0)GO TO 35                                              19000
      ICAR = KORDG*1000+KORMN                                           19100
      IF(CORAD,LT,C,0)KORGLD = KORDG+1                                  19200
      GO TO 50                                                          19300
   35 ICAR = KORDG                                                      19400
      NK = NK+3                                                         19500
      GO TO 50                                                          19600
```

```
 40 NK = -2                                                          19700
    ICAR = KORMN                                                     19800
 50 JK = XABSF(NK)                                                   19900
    DO 60 LZ=1,JK                                                    20000
 60 LTT(LZ) = 0                                                      20100
    CALL BULAB(ICAR,JK,LTT(1))                                       20200
    GO TO(300,120,130,300,150,160)JK                                 20300
120 LTT(3) = LTT(4) = LTT(5) = LTT(6) = IBLNK                        20400
    GO TO 200                                                        20500
130 LTT(4) = LTT(5) = LTT(6) = IBLNK                                 20600
    GO TO 200                                                        20700
150 LTT(3) = LTT(6) = IBLNK                                          20800
    GO TO 200                                                        20900
160 LTT(4) = IBLNK                                                   21000
200 CALL APACK(JK,LTT(1),ICAT)                                       21100
    GO TO(250,260)IAX                                                21200
250 MNMER(IK) = ICAT                                                 21300
    NNC(IK) = NK                                                     21400
    XL(IK) = ALOC                                                    21500
    KXAXIS = KXAXIS+1                                                21600
    IK = IK+1                                                        21700
    GO TO 300                                                        21800
260 MNPAR(IK) = ICAT                                                 21900
    NY(IK) = NK                                                      22000
    YK(IK) = ALOC                                                    22100
    KYAXIS = KYAXIS+1                                                22200
    IK = IK+1                                                        22300
300 RETURN                                                           22400
    END                                                              22500
```

```
PROGRAM LENGTH              00340     IDENT     CHFOLB
ENTRY POINTS    CHFOLB      00016
BLOCK NAMES
                INPT        00133
                CHTLBL      00473
EXTERNAL SYMBOLS
                Q1C10100
                OOCDICT
                RTEDM
                BULAB
                APACK
  00145 SYMBOLS
```

```
      SUBROUTINE DTOR(DEG,AMIN,SEC,RAD)                              55800
C     CONVERSION OF DEGREES, MINUTES, SECONDS INTO RADIANS           55900
      DG=ABSF(DEG)                                                   56000
      PI=3.141592654                                                 56100
      DEGD=SIGNF((DG+AMIN/60.+SEC/3600.),DEG)                        56200
      RAD=PI*DEGD/180.0                                              56300
      RETURN                                                         56400
      END                                                            56500
```

```
                                IDENT     DTOR
PROGRAM LENGTH              00111
ENTRY POINTS    DTOR        00003
EXTERNAL SYMBOLS
                OSCDICT,
      SUBROUTINE FINDA(RR,X,Y,ALTX,ALTN,ALGX,ALGN,A,ITR)                    56600
C        THIS SUBROUTINE IS USED TO CALCULATE THE SEMI-MAJOR AXIS OF THE    56700
C        SPHEROID IN PLOTTER UNITS -- NO FURTHER CONVERSIONS ARE NECESSA     56800
C        NECESSARY TO OUTPUT UNITS TO THE PLOTTER                           56900
      IF(X)10,10,30                                                         57000
   10 IF(Y)50,50,20                                                         57100
   20 CALL MERCTR(1,1,0,RR,ALTX,ALGX,DUMMY,FLAMX)                           57200
      CALL MERCTR(1,1,0,RR,ALTN,ALGN,DUMMY,FLAMN)                           57300
      A=ABSF(Y/(FLAMX-FLAMN))                                               57400
      ITR = 2                                                               57500
      GO TO 40                                                              57600
   30 A=ABSF(X/(ALGX-ALGN))                                                 57700
      ITR = 1                                                               57800
C   RESTORE BASE MERIDIAN AND PARALLEL IN MERCTR                            57900
   40 CALL MERCTR(1,A,RR,ALTN,ALGN,B0B0,D0D0)                               58000
C     FIND ACTUAL HEIGHT AND WIDTH OF CHART                                 58100
      CALL MERCTR(0,A,RR,ALTX,ALGX,XMAX,YMAX)                               58200
      CALL MERCTR(0,A,RR,ALTN,ALGN,XMIN,YMIN)                               58300
      X = XMAX-XMIN                                                         58400
      Y = YMAX-YMIN                                                         58500
      RETURN                                                                58600
   50 ITR = -1                                                              58700
      RETURN                                                                58800
      END                                                                   58900
```

```
                                IDENT     FINDA
PROGRAM LENGTH              00246
ENTRY POINTS    FINDA       00003
EXTERNAL SYMBOLS
                OSCDICT,
                MERCTR
   00105 SYMBOLS
      SUBROUTINE MERCAT                                                     87800
      COMMON/MARSYS/    CORR(4),    RR,         DEL,        ACHT,         87900
     1                  IPR,        XMIN,       YMIN,       XMAX,         88000
     2                  YMAX,       MP,         ICR,        IA,           88100
     3                  RAWI,       RAWI                                  88200
                                                                            88300
C
      COMMON/INPT/ALATND, ALATNM, ALATNS, ALATXD, ALATXM, ALATXS,           88400
     1             ALOGND, ALOGNM, ALOGNS, ALOGXD, ALOGXM, ALOGXS,        88500
     2             INPC,   KOMP,   WIDTH,  HITE,   DEGDVD, DEGDVM,        88600
     3             DEGDVS, NTIC,   TICLGT, ALTMD(5),ALTMM(5),ALTMS(5),    88700
     4             ALNMD(5),ALNMM(5),ALNMS(5),ALTSD(5),ALTSM(5),ALTSS(5), 88800
     5             ALNSD(5),ALNSM(5),ALNSS(5),AR(5),   VR(5)              88900
                                                                            89000
C
      CALL FINDA(RR,WIDTH,HITE,CORR(2),CORR(1),CORR(4),CORR(3),ACHT,IRT)    89100
      IF(IRT)130,130,100                                                    89200
```

```
100   CONTINUE                                                                  89400
      RAHI = (CORR(2)-CORR(1))/HITE                                             89500
      RAWI = (CORR(4)-CORR(3))/WIDTH                                            89600
      CALL MERCTR(0,ACHT,RR,CORR(1),CORR(3),XMIN,YMIN)                          89700
      CALL MERCTR(0,ACHT,RR,CORR(2),CORR(4),XMAX,YMAX)                          89800
  120 RETURN                                                                    89900
  130 WRITE(IPR,101)                                                            90000
      GO TO 120                                                                 90100
  101 FORMAT(*   INSUFFICIENT INFORMATION TO COMPLETE PLOT*)                    90300
      END
```

```
                                    IDENT     MERCAT
PROGRAM LENGTH                00071
ENTRY POINTS     MERCAT       00014
BLOCK NAMES
                 MAPSYS       00021
                 INFT         00133
EXTERNAL SYMBOLS
                 THEND,
                 OBCDICT,
                 FINDA
                 MERCTR
                 SYM,
    00104 SYMBOLS
```

```
      SUBROUTINE MERCTR(IT,A,RR,ALAT,ALON,X,Y)                                  90400
      IF(IT)10,20,10                                                            90500
   10 BM = ALON                                                                 90600
      BP = ALAT                                                                 90700
      XB = A*BM                                                                 90800
      E = SQRTF(1.0-RR*RR)                                                      90900
      E2 = E/2.0                                                                91000
      SINBP = SINF(BP)                                                          91100
      ESINBP = E*SINBP                                                          91200
      YB = A*LOGF((1.0+SINBP)/COSF(BP)*((1.0-ESINBP)/(1.0+ESINBP))**E2)         91300
      X = XB                                                                    91400
      Y = YB                                                                    91500
      RETURN                                                                    91600
   20 SINLA = SINF(ALAT)                                                        91700
      ESINLA = E*SINLA                                                          91800
      XA = A*ALON                                                               91900
      X = XA-XB                                                                 92000
      YA = A*LOGF((1.0+SINLA)/COSF(ALAT)*((1.0-ESINLA)/(1.0+ESINLA))**E2)       92100
      Y = YA-YB                                                                 92200
      RETURN                                                                    92300
      END                                                                       92400
```

```
                                        IDENT     MERCTR
PROGRAM LENGTH              00251
ENTRY POINTS    MERCTR      00003
EXTERNAL SYMBOLS
                02C07111
                08CDICT
                SQRTF
                SINF
                LOGF
                COSF
   00073 SYMBOLS

      SUBROUTINE TICX                                                          140000
C                                                                              140100
C*************************************************************************     140200
C *                                                                           140300
C * THIS SUBROUTINE STORES VALUES IN AN ARRAY THAT ARE USED FOR PLOTTING      140400
C * TICK MARKS ON A MERCATOR OR INVERSE MERCATOR PROJECTION CHART             140500
C *                                                                           140600
C*************************************************************************     140700
C                                                                              140800
      COMMON/MARSYS/    CORR(4),      RR,           DEL,          ACHT,      140900
     1                  IPR,          XMIN,         YMIN,         XMAX,      141000
     2                  YMAX,         MP,           ICR,          IA,        141100
     3                  RAHI,         RAHI                                   141200
C                                                                              141300
      COMMON/INPT/ALATND,  ALATNM,  ALATNS,  ALATXD,  ALATXM,  ALATXS,       141400
     1             ALOGND,  ALOGNM,  ALOGNS,  ALOGXD,  ALOGXM,  ALOGXS,      141500
     2             MPC,     KOMP,    WIDTH,   HITE,    DEGDVD,  DEGDVM,      141600
     3             DEGDVS,  NTIC,    TICLGT,  ALTMD(5),ALTMM(5),ALTMS(5),   141700
     4             ALNMD(5),ALNMM(5),ALNMS(5),ALTSD(5),ALTSM(5),ALTSS(5),   141800
     5             ALNSD(5),ALNSM(5),ALNSS(5),AR(5),   VR(5)                 141900
      COMMON/FIXGRAT/DDL,NTIX
C                                                                              142000
      DEGW=CORR(4)*CORR(3)                                                     142100
      XINCR=XMAX*DDL/(DEGW*NTIX)
C                                                                              142300
C***TICK MARKS ON LOWER BORDER OF CHART                                        142400
C                                                                              142500
      IF(TICLGT.LE.0.0)TICLGT=0.06                                             142600
  100 TIC = TICLGT                                                             142700
      Y0 = YMIN                                                                142800
   60 M = 0                                                                    142900
      XX = XMIN                                                                143000
   10 XX=XX+XINCR                                                              143100
      IF(XX .GE. XMAX)30,15                                                    143200
   15 M=M+1                                                                    143300
      IF(M-5)2,1,4                                                             143400
    1 TIC=2.0*TIC                                                              143500
      GO TO 3                                                                  143600
    4 IF(M-10)2,6,6                                                            143700
    6 TIC=3.0*TIC                                                              143800
      M = 0                                                                    143900
      GO TO 3                                                                  144000
    2 TIC=TIC                                                                  144100
    3 CALL PLOT(XX,Y0,3)
      YA = Y0+TIC                                                              144300
      CALL PLOT(XX,YA,2)
      GO TO 10                                                                 144500
```

```
C
C**** TICK MARKS ON UPPER BORDER OF CHART                                144600
C                                                                        144700
  30  IF(Y0 .GE. (YMAX-0.0005))55,35                                     144800
  35  Y0=YMAX                                                            144900
      TIC=TIC                                                            145000
      GO TO 60                                                           145100
  55  CALL PLOT(XMIN,YMIN,3)                                             145200
  70  RETURN
      END                                                                145400
                                                                         145500
```

```
                                        IDENT     TICX
PROGRAM LENGTH              00135
ENTRY POINTS     TICX       00003
BLOCK NAMES
                 MAPSYS     00021
                 INPT       00133
                 FIXGRAT    00002
EXTERNAL SYMBOLS
                 01C04100
                 OBCDICT,
                 PLOT
   00124 SYMBOLS
```

```
      SUBROUTINE TICY                                                    145600
C                                                                        145700
C************************************************************************ 145800
C *                                                                      145900
C * THIS SUBROUTINE STORES VALUES IN AN ARRAY THAT ARE USED FOR PLOTTING 146000
C * TICK MARKS ON A MERCATOR OR INVERSE MERCATOR PROJECTION CHART,       146100
C *                                                                      146200
C************************************************************************ 146300
C                                                                        146400
      COMMON/MAPSYS/    CORR(4),     RR,          DEL,         ACHT,     146500
     1                  IPR,         XMIN,        YMIN,        XMAX,     146600
     2                  YMAX,        MR,          ICR,         IA,       146700
     3                  RAWI,        RAWI
C                                                                        146800
      COMMON/INPT/ALATND, ALATNM, ALATNS, ALATXD, ALATXM, ALATXS,        146900
     1             ALOGND, ALOGNM, ALOGNS, ALOGXD, ALOGXM, ALOGXS,       147000
     2             NPC,    KOMP,   WIDTH,  HITE,   DEGDVD, DEGDVM,       147100
     3             DEGDVS, NTIC,   TICLGT, ALTMD(5),ALTMM(5),ALTMS(5),   147200
     4             ALNMD(5),ALNMM(5),ALNMS(5),ALTSD(5),ALTSM(5),ALTSS(5), 147300
     5             ALNSD(5),ALNSM(5),ALNSS(5),AR(5),   VR(5)              147400
C                                                                        147500
  60  ALAT=CORR(1)                                                       147600
      YINCR=DEL/NTIC                                                     147700
      IF(TICLGT.LE.0.0)TICLGT=0.06                                       147800
 100  TIC = TICLGT                                                       147900
      XX = XMIN                                                          148000
      MI = 3                                                             148100
 200  N = 0                                                              148200
      YY = YMIN                                                          148300
 100  ALAT=ALAT+YINCR                                                    148400
      CALL MERCTR(0,ACHT,RR,ALAT,CORR(MI),DUM,YY)                        148500
      IF(YY .GE. YMAX)99,20                                              148600
                                                                         148800
```

```
 20   N=N+1                                                          148900
      IF(N-5)5,4,15                                                  149000
 4    TIC1=2.0*TIC                                                   149100
      GO TO 6                                                        149200
 15   IF(N-10)5,17,17                                                149300
 17   TIC1=3.0*TIC                                                   149400
      N = 0                                                          149500
      GO TO 6                                                        149600
 5    TIC1=TIC                                                       149700
 6    CALL PLOT(XX,YY,3)
      XA = XX+TIC1                                                   149900
      CALL PLOT(XA,YY,2)
 35   GO TO 100                                                      150100
 99   IF(XX .GE. (XMAX-0.0005))105,48                                150200
 48   XX=XMAX                                                        150300
      TIC=-TIC                                                       150400
      ALAT=CORR(1)                                                   150500
      MI = 4                                                         150600
      GO TO 200                                                      150700
 105  CALL PLOT(XMIN,YM,N,3)
 401  RETURN                                                         154300
      END                                                            154400
```

```
                                        IDENT     TICY
PROGRAM LENGTH              00147
ENTRY POINTS     TICY       00003
BLOCK NAMES
                 MAPSYS     00021
                 INPT       00133
EXTERNAL SYMBOLS
                 Q1C05100
                 Q8CDICT,
                 MERCTR
                 PLOT
   00127 SYMBOLS
```

```
      SUBROUTINE BLLAB(INLAB,KJ,ITEMP)                               13300
      DIMENSION ITEMP(KJ)                                            13400
      ILAB=INLAB                                                     13500
      DO 10 IK=1,M.                                                  13600
      K=KJ-IK+1                                                      13700
      ITEMP(K)=MOD(ILAB,10)                                          13800
      ILAB=ILAB/10                                                   13900
      IF(ILAB)10,11,10                                               14000
 10   CONTINUE                                                       14100
 11   RETURN                                                         14200
      END                                                            14300
```

```
PROGRAM LENGTH                  IDENT     BULAB
ENTRY POINTS     BULAB    00103
EXTERNAL SYMBOLS          00003
                 Q8CDICT,
                 XMCDF
   00033 SYMBOLS
```

```
      SUBROUTINE RTODM(RAD,IDEG,AMIN)                                    128400
      PI = 3.1415926535                                                  128500
      RTOD = 180.0/PI                                                    128600
      DELTA = 0.0000001                                                  128700
      DEG = SIGNF((ABSF(RAD)*RTOD+DELTA),RAD)                            128800
      IDEG = DEG                                                         128900
      AMIN = ABSF(DEG-IDEG)*60.0                                         129000
      RETURN                                                             129100
      END                                                                129200
```

```
PROGRAM LENGTH                  IDENT     RTODM
ENTRY POINTS     RTODM    00114
EXTERNAL SYMBOLS          00003
                 Q1C10100
                 Q1C03100
                 Q8CDICT,
   00033 SYMBOLS
```

```
C     SUBROUTINE ANGANG (XPT,XA,YPT,YA,ANG)                              G   1
C     COMPUTES ANGLE OF ROTATION FOR ANNOTATION                          G   2
      PI=3.141592653                                                     G   4
      XRAD=0.01745329                                                    G   5
      TEMP=ANG                                                           G   6
      IF (XPT-XA) 1,10,1                                                 G   7
    1 ARG=(YPT-YA)/(XPT-XA)                                              G   8
      IF (ARG) 2,4,6                                                     G   9
    2 IF (YPT-YA) 3,4,9                                                  G  10
    3 ANG=(ATAN(ARG))/XRAD                                               G  11
      GO TO 14                                                           G  12
    4 IF (XPT-XA) 5,10,10                                                G  13
    5 ANG=PI/XRAD                                                        G  14
      GO TO 14                                                           G  15
    6 IF (YPT-YA) 7,4,8                                                  G  16
    7 ANG=(ATAN(ARG)+PI)/XRAD                                            G  17
      GO TO 14                                                           G  18
    8 ANG=(ATAN(ARG))/XRAD                                               G  19
      GO TO 14                                                           G  20
    9 ANG=(ATAN(ARG)+PI)/XRAD                                            G  21
      GO TO 14                                                           G  22
   10 IF (YPT-YA) 11,13,12                                               G  23
   11 ANG=270.0                                                          G  24
      GO TO 14                                                           G  25
   12 ANG=90.0                                                           G  26
      GO TO 14                                                           G  27
   13 ANG=TEMP                                                           G  28
   14 RETURN                                                             G  29
      END                                                                G  30
                                                                         G  31.
```

```
                                        IDENT     ANGANG
PROGRAM LENGTH              00242
ENTRY POINTS    ANGANG      00003
EXTERNAL SYMBOLS
                QBCDICT,
                ATANF
   00076 SYMBOLS

      SUBROUTINE FIXANG(XPT,YPT,ANG,CHAR,KOUNT,ILINE,IPT,IUP)
C     ANNOTATES FIX NUMBERS                                              I   2
C                                                                        I   4
      AHT=0.07
      NFIG=3
      XRAD=0.01745329                                                    I   5
      CNG=ANG+90.                                                        I   6
      IF (MOD(KOUNT,2).NE.0) GO TO 1                                     I   7
C     ANNOTATES FIGURES TO THE RIGHT HAND SIDE OF THE DATA POINT         I   8
      XP=XPT                                                             I   9
      YP=YPT                                                             I  10
      GO TO 4                                                            I  11
C     ANNOTATES FIGURES TO THE LEFT HAND SIDE OF THE DATA POINT          I  12
    1 BNG=(CNG+180.)*XRAD                                                I  13
      IF (NFIG.GT.4) GO TO 2                                             I  14
      HYP=AHT*(6./7.)*(NFIG+1)                                           I  15
      GO TO 3                                                            I  16
    2 HYP=AHT*(6./7.)*NFIG                                               I  17
    3 YY=HYP*SINF(BNG)                                                   I  18
      XX=HYP*COSF(BNG)                                                   I  19
      YP=YPT+YY                                                          I  20
      XP=XPT+XX                                                          I  21
C ILINE=0 EVERY POINT    ILINE=1  EVERY N TH POINT ANNOTATED
C  ILINE=2  PLOT VALUE SERIES  NO ANNOTATION
 4    IF(ILINE-1)10,11,9
 11   IF(MOD(KOUNT,IPT),NE.1) GO TO 9
      CALL PLOT(XPT,YPT,IUP)
      CALL NUMBER(XP,YP,AHT,CHAR,CNG,2HF5)
      CALL PLOT(XPT,YPT,3)
      CALL SYMBOL(XPT,YPT,0.105,0,0,0,-1)
      GO TO 7
 9    CALL PLOT(XPT,YPT,IUP)
      GO TO 7
 10   CALL NUMBER (XP,YP,AHT,CHAR,CNG,2HF5)
      CALL PLOT(XPT,YPT,3)
 20   CALL SYMBOL(XPT,YPT,0.020,3,0,0,-1)
      GO TO 7
    7 CALL PLOT (XPT,YPT,3)                                              I  31
      IUP=2
    8 RETURN                                                             I  43
      END                                                                I  44
```

```
PROGRAM LENGTH                  IDENT     FIXANG
ENTRY POINTS     FIXANG         00332
EXTERNAL SYMBOLS                00005
                 Q9C04100
                 QBCDICT,
                 PUCT
                 NUMBER
                 SYMBOL
                 XMCDF
                 SINF
                 COSF
      00133 SYMBOLS
LOAD


ABORT, UN UNIT          READ ATTEMPT ON UNASSIGNED UNIT,MUST HAVE EQUIP
                        DECLARATION, YOU HAVE TRIED TO READ FROM A UNIT THAT
                        HAS NOT BEEN WRITTEN ON, IF LUN=69,CHECK FORTRAN CARD
                        FOR X OPTION,

    LUN = 69
```

```
OE MESSAGES
                JOB,002171, 3600,009MLB
                 TERM, UN UNIT

SEQUENCE NUMBER 002171 TERMINATED AT     214541 ELAPSED TIME= 00 HRS, 00 MIN, 59 SEC, OR   59128 MILLISECONDS
XXXMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMXXX
XXXMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMXXX
XXXMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMXXX

THE TOTAL NUMBER OF LINES PRINTED FOR THIS JOB WAS        1137
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